iGEM 2014

WEEKLY NEWSLETTER

iGEM 2014
Issue N°2

NEWSLETTER N°2

from August 11th to August 24th

COLOMBIA

OUR TEAM

We are iGEM Colombia Team, we are students from Universidad de los Andes in Bogotá, Colombia and this is our fourth year in the iGEM Competition.

In 2012 the team won the Regional Jamboree with a bacteria capable of detecting a phytopathogen and alerting the plant of its presence. Students from biological sciences, medicine, physics, chemistry, computer and chemical engineering comprise our team. We have students from different ages: we have master students that help the smaller ones to learn the techniques and undergraduate students that go from freshman to senior year.

OUR PROJECT

Make a Sierpinski triangle pattern appear in a grid
Conjugate quorum sensing and logic gates in bacterial colonies
Implement an XOR gate in an E. coli
Characterize integrases (retrieve missing parameters)
Study quorum sensing mechanism aiming to lower the leakiness
Be able to predict accurately the system's behavior

Questions it raises :
How can a complex pattern emerge from a simple logic rule?

What is to be considered as simple or complex?

How can leakiness, noise and lack of robustness in biological systems be handled?

Cholera, caused by the bacterial pathogen Vibrio cholerae, has been a scourge to civilizations the world over since ancient times. Our project aims to use synthetic biology to develop a V. cholerae sensor using a new technique. We propose detecting V. cholerae's species-specific quorum sensing molecule. If we rewire V. cholerae's own quorum sensing mechanism in a harmless E. coli chassis, we can build a biosensor that gives a color output when it senses the pathogen.

We have finished our deterministic model, but we still have problems with the parameters , as usual. At the lab we just finished InterLab parts and 3 biobricks of our own project ... we are still working on more parts, specially Tetracycline Repressor from the registry, which has a strange molecular weight.

We also had a Bake Sale this week and collected funds to go to the Jamboree. At our HP practices project we have received a lot of collaboration from many teams. THANK YOU SO MUCH. If you want to know what we are doing and want to collaborate, contact us .

Our system is based in a phosphorylation cascade that is reversed in the presence of an Auto inductor (CAI-1). When there is V. Cholerae in the media CqsS senses it and changes it functions to phosphase. CqsS takes the phosphate from LuxU, which takes the phosphate from LuxO and turns off the production of TetR (Repressor of pTet). This process allows the production of the signal Amilcp and the activator TetA ,creating a positive feedback.

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ETH ZÜRICH

PROJECT UPDATE

Mosaicoli aims to investigate emergence of complex patterns by engineering a cellular automaton in bacteria. The design of our system was only a first step. While the wet lab worked hard to assemble our constructs, the dry lab focused on the deterministic model and its parameters. Finally, this week, we began to do our first experiments. They concern the quorum sensing module of our system. After fitting our deterministic model with the first results, we aim to investigate cross-talk between different AHLs and their diffusion.

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GOETTINGEN

PROJECT UPDATE

We selected different surface proteins from Candida albicans, Aspergillus fumigatus, Aspergillus nidulans, Candida glabrata, Toxoplasma gondii and Saccharomyces cerevisiae and amplified them via PCR, avoiding glycosilated regions.

So far, we have 18 amplified genes of interest, six of which are cloned in yeast and the rest is still in the sequencing stage. After the first round of the yeast two-hybrid assay, we have found some peptides that potentially bind the six genes cloned in yeast, which will be further tested for confirmation. We have also constructed a new peptide library.We presented these results at the symposium of the Goettingen Center for Molecular Biosciences and received feedback from the researchers of the institute.Now we are organizing the SynBio Day in our city on the 15th of August, following what was discussed at the team meetup held in Munich: we will have a boot in the city center of Goettingen where we will talk to pedestrians and answer the questions they may have about synthetic biology. We will also have some activities where people can win some prices from one of our sponsors.

Many biochemical and biological events can take place when two molecules interact with each other. Our screening method is, generally speaking, a way to find new molecules with potential biological applications. This pipeline should allow other researchers to select novel biological parts that interact with their protein(s) of interest, and which can be further refined to increase specificity and modified to add functionalities.In our project, the selected peptides will be attached to a fluorescent tag and submitted to the biological part registry. However, the modifications are not restricted to a fluorescent tag: radioactively labeled compounds, attachment of different functional groups and immunoactive tags, among others, are also options that can be explored.

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LIKA-CESAR-BRASIL

OUR TEAM

For the first time on the iGEM competition, the LIKA-CESAR-BRASIL Team is a mix of students from different areas of knowledge. The formation of the team started with the willingness to innovate within the biology field of students of Laboratory of Immunopathology Keizo Asami (LIKA) and the Center for Advanced Studies and Systems of Recife (CESAR), which includes the participation of members from both institutes.

OUR PROJECT

The association LIKA-CESAR-BRASIL Team will show the competition an innovative project of biosensors for early detection of breast cancer.

According to the World Health Organization, breast cancer is the most frequent type of cancer among the women worldwide, both in developing as well as developed countries. Most deaths from this disease occur in low and middle income, because the patients are diagnosed in advanced stages of the disease. Besides the delay in detecting the tumor, often the resolution on the most effective treatment is compromised by lack of technical and accurate diagnostic system.

Currently, the diagnosis occurs using image techniques such mammography and magnetic resonance, which is very expensive and not portable. One way out of this problem would be the use of biosensors. This technology is capable of diagnosing infectious diseases, genetic, metabolic and others. A biosensor is a device that incorporates a biological element with a physical transudor to generate a measurable signal proportional to the analyte concentration.

Joining LIKA's scientific experience with C.E.S.A.R.'s technological skills, a the multidisciplinary team is developing a biosensor for the detection of breast cancer with the help of robotics. The idea is to build a system, which is able to process, and prepare small blood samples in an automated mode through help of bacteria. This system will be coupled to biosensors that are capable of detecting breast cancer in its early stages. The goal is to shorten the analysis of samples from patients that currently take 4-6 hours to less than 30 minutes. The automation of the entire process, together with the creation of a specific biosensor for breast cancer, will result in a future decrease in deaths from the disease, due to a more rapid and effective treatment.

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PARIS BETTENCOURT

PROJECT UPDATE

Plan for future steps:

This is a small scale experiment, but it seems to lead us somewhere. As part of our Citizen Science project, we would like to project a horror movie in a local cinema and get at least 50 samples.

Movies project – How our mood changes of body odor
The aim of the project was to determine if body odor changes with our mood. We also wanted to determine if a 5 minute clip was enough to make a change in the smell or if it was necessary to watch a whole movie.

We analyzed the odor of some volunteers before and after watching a clip and a movie that showed a specific emotion –fear, love, sadness, happiness. It was the first time they ever watched the movie.

Before the clip, we showed a white screen during 30 seconds. Volunteers were asked to relax and empty their minds. After the clip, we showed a nature documentary (as it is supposed to set us in a neutral mood state). Before the movie, a white screen was shown again during 30 seconds.

Other volunteers smelled the samples and answered:
How pleasant is the smell? (0 the least – 5 the most)
How strong is the smell? (0 the least – 5 the most)

Results:
Happy movie : Two people were asked to watch 'Liar, Liar'. Results are not very conclusive. The volunteers told us the movie was not specially happy or funny.

Romantic movie : One person was asked to watch ' Love actually'. After the movie, the smell is perceived as less strong and less pleasant.

Sad movie : One volunteer watched 'My sister's keeper'. The smell after the movie is perceived as stronger and less pleasant.

Horror movie : This is the smell of one volunteer, tested by three different people. After the movie 'The silence of the lambs', they all rated the body odor as less pleasant and stronger.

We repeated the experiment with another volunteer, and asked two people to rate the smell. We had the same results. One person rated the sample over the scale (6) for the question 'How strong is the smell?' .

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POLYTECHNIC UNIVERSITY OF VALENCIA

PROJECT UPDATE

The last two weeks have been very motivational for all of us. Our first provisional constructions for pheromones biosynthesis have been prepared and already tested in plant, our first partial results will come soon! In the meantime, multigenic and more complex constructions are being developed for future trials.

We have started with the construction of a translator from GoldenBraid (the assembly system we are using) to Biobricks, so future iGEM teams can use our modules in Biobricks format. A specific promoter for glandular trichomes is a few steps away from being tested in plants and depending on the results, new approaches will be used. The design of our cooper-activated genetic switch is complete and we are waiting for the parts to arrive so we can start building it.

We are also having some difficulties amplifying a gene we want to introduce into our system to produce an extra pheromone. Hopefully we will solve these problems soon so we can enrich the #SexyPlant with even more features. Please summon the demons of the failed PCRs and make them stop annoying us.

We started a collaboration with NRP-UEA-Norwich team to create a common biosafety module, since both of our teams are working in N benthamiana. Our biosafety module will have a male sterility part, to prevent spreading of the genetic material, and identity preservation part which will confer the plant a different color, so it is easily distinguishable. This biosafety module will be fully compatible with Biobricks, so future teams working in plants can incorporate it in their systems.

Plan for future steps:
We will test new, more complex multigenic constructions in N benthamiana. Glandular trichome specific promoters will also be tested with GFP in N benthamiana. Parts from NRP-UEA-Norwich team and our own parts need to be adapted to each other in order to build the biosafety module.
We hope the last gene of our set of pathways is finally amplified before the next newsletter is finished and that the translator is finally built. The sooner the better.
Stay tuned for our updates!

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TONGJI

OUR TEAM

Our team consists of students from biotechnology major and bioinformation major. The group formed when we got the information about the 2014 iGEM competition in winter vacation. We have close relationship with other universities in Shanghai, which offers us many chances to ask for help and assist other universities.

OUR PROJECT

I can talk about what has happened in the last two weeks.

We did PCR with C. stercorarium as template to get gene of XynB. Then we connect it to T-vector.

So we can build some T-vector which contained our target gene. We were using blue-white selection method for our experiment. The experiment went well and we have cultivated some E.coli which contained our target gene. We are going to do plasmid extraction and splice our target gene from T-vector to the expression vector.

We also get some expression vector from another lab in our college. However, the amount was not enough for our project. So we did some common experiments to make it enough.

Our project is about using an enzyme to biobleach paper pulp.

Plan for future steps:

We need to build an expression vector to verify our expectation and we will build vectors which is based on pSB1C3 for iGEM submitting.

We want to set up a line chart about the bleaching effect of enzyme and the concentration of the enzyme. This task will be done by GAO Jian.

We also want to call some paper factories and take a visit. In that case, We can find out what bleaching method is really being used in manufactory. And we will study the cost-effectiveness of our method.

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PURDUE

OUR TEAM

2006 was the first year that Purdue participated in iGEM, entering the competition with seven undergraduate members and three advisers. Purdue continued to compete for the next four years, earning bronze medals almost every year but never anything more. Due to lack of interest, financial support, and time, Purdue did not field a team in the 2011 iGEM competition. Fortunately, the team was revived with enough interest and support to not only field a team in 2012, but receive a gold medal and advance to the international competition at MIT for the first time in the team's history.
In 2013, the Biomakers were ranked regional finalists with their project: "Back to the Basics of Synthetic Biology". They also received the award for Best New Natural BioBrick, and advanced to the international competition!

OUR PROJECT

This year the Purdue iGEM Team is tackling the problem of global malnutrition with our new project: Minecrobe! More than 870 million people are malnourished according to the United Nations World Food Program, and the World Health Organization states that iro deficiency is one of the most common and widespread nutritional disorders in the world. We plan to utilize synthetic biology to combat this problem by engineering Bacillus subtillus to increase plants' ability to uptake iron from the soil, through production of plant phytosiderophores.

As the summer comes to a close, we've finished our main plant control experiment, we're working on optimizing our transformation protocol for bacillus, and we're waiting for our synthesized DNA to come in. The goal of the plant control experiment was to find out how corn and rice grow at different levels of iron available in the soil. We had 48 corn and 48 rice plants grow in a range from 0% to 150% recommended iron content, and grew them for 4 weeks. We took pH readings, height measurements, and chlorophyll measurements at regular intervals to gauge how the plants reacted to the varying levels of iron. At the end of the experiment we took leaf samples from each plant, and are planning on using ICP-MS to quantitatively find out how much iron the plants had absorbed. We'll be able to use this data when we compare the plants grown with our modified bacillus in the future.

Plan for future steps:
In the coming weeks, are going to finalize our bacillus transformation protocol and then transform our constructs into the three strains we have in our lab. We then plan to do a siderophore assay to confirm that our constructs are working as expected, and then choose our final strain based on the quantity of phytosiderophores being produced. Once we have chosen our strain, we are going to start the final plant experiment to see how our modified Bacillus affects plant growth.

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STANFORDBROWNSPELMAN

OUR TEAM

Our team has participated in the last four iGEM competitions.

OUR PROJECT

With the exponential growth of interest in unmanned aerial vehicles (UAVs) and their vast array of applications in both space exploration and terrestrial uses such as the delivery of medicine and monitoring the environment, the 2014 Stanford-Brown-Spelman iGEM team is pioneering the development of a fully biological UAV for scientific and humanitarian missions.

We are working to engineer cells to synthesize cellulose acetate as a novel bioplastic, characterize biological methods of waterproofing the material, and program this material's systemic biodegradation. In addition, we aim to use an "amberless" system to prevent horizontal gene transfer from live cells on the material to microorganisms in the flight environment.

So far, we have: successfully transformed Gluconacetobacter hansenii, a cellulose-producing bacterium, with a series of promoters to test transformation efficiency before adding the acetylation genes; isolated novel waterproofing protein bands present in wasp nest material; transformed the cellulose-degrading genes into Escherichia coli; and we have confirmed that the amberless construct prevents protein expression in wild-type cells. In addition, as part of our human outreach project, we have been in touch with leaders in the fields of UAVs, synthetic biology, and earth sciences, and it is clear that biodegradable UAVs could have a significant impact on the industry.

Plan for future steps:
For the production of cellulose acetate, we plan to use directed evolution to select for those organisms which produce the polymer with highest acetate content.

For our wasp protein waterproofing project, we plan to transform yeast with the genes for the cellulose waterproofing proteins and run a high throughput assay to isolate the colonies that produce the most water-resistant products.

Finally, for our biodegradability project, we plan to link the production of our esterases and cellulases with a quorum sensing time-delay mechanism.

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SHEFFIELD

OUR TEAM

We are an interdisciplinary team of eight undergraduates, consisting of five engineers and three biologists hailing from four different countries. We were assembled earlier in the year by five PhD student advisors and having decided it was critical to tackle a real world problem, we asked the general public what sort of problems they faced on a regular basis. Many replies were made by people stating that they often had problems with pipe blockages, and from there our project began.

We are the third team from Sheffield to enter the iGEM competition, and the first since 2010. We are aiming for victory in the manufacturing track!

OUR PROJECT

The accumulation of fat and hair deposits in sewer systems is increasingly problematic in urban areas, causing disruption to the public and costing water companies a lot of money.

FOG (fats, oils and greases) pollutants mainly originate from homes and restaurants, who dispose of used cooking oil down the sink rather than in the bin. Our idea is to engineer E. coli to secrete lipase and keratinase enzymes to break down these deposits before the blockages have the chance to form.

Plan for future steps:

We are working on methods of inserting the bacteria into the pipe in a way that is both cost-effective and practical. We also intend to research where the responsibility for dealing with damage from environmental pollutants lies.

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SJTU-BIOX-SHANGHAI

OUR TEAM

The iGEM team of SJTU is supported by Bio-X Institutes of Shanghai Jiao Tong University, founded in 2009. We were the Grand Prize Winner of Asia in 2012, and won Best New BioBrick Devices and gold medals in the past five years.

Our team consists of undergraduates with biology background. Make science and technology serve production more effectively is our constent pursuit. This year, our team focus on protein multimerization system in cytomembrane and we hope MembRing can bring new ideas and greater efficiency to the relevant industrial practices.

OUR PROJECT

Use recognition of DNA-binding proteins and specific nucleic acid sequences to achieve proteins multimerization

Remold connecters(plasmids) to achieve selective combination of different enzymes

Explore the maximum number of enzymes that can be connect on a single connecter.

This year, we bring MembRing – an annular protein multimerization system in cytomembrane.

This system will help us achieve the goal of selective polymerization of enzymes. Polymerized enzymes, different from normal scattered condition, has much more opportunities to contact with the substrates. Therefore, our project aims to increase as well as control the efficiency of complex reactions.

The basic function, polymerization, is carried out by a circular DNA and DNA-binding protein to polymerize enzymes. First, a fluorescent protein, a transmembrane domain, an enzyme and a DNA binding protein are connected in order, forming a complex that the FP locates outside the film while the enzyme and DNA binding protein are in cytoplasm. Then integrate specific matching DNA sequences onto an exogenous plasmid and co-transform this connecter with expression vectors into E.Coli to associate enzymes.

In addition, we plan to make the enzymes selectable by remolding the connecter with different recognition sequences and co-transforming it with expression vectors. This will help the whole project to work in all kinds of practical applications.
During this year, our team has already had many opportunities to interact with other teams. We find those communications inspiring to both sides. Thus, we welcome any kinds of comments or questions. Let's work together to ake this year wonderful!

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TECHNION ISRAEL

OUR TEAM

11 engineering students and one design student form the 2014 iGEM team. This is only the second time the Technion is participating in iGEM, and the third year an Israeli team is taking part in the competition.
We are passionate not only about science but also about educating children and youth in Israel from all walks of life.

OUR PROJECT

Detection of allergens and toxins in food and water is a very important issue, which is difficult to solve, mainly because the detection must be done at very low concentrations. Our team is paving the path to a cheap and accessible solution to this issue by planning a bio-sensor system that can accurately identify a substance of interest at extremely low concentrations.
We are programming E.Coli bacteria to sense the presence of a specific substance and process the signal to produce a green light as well as signal to neighboring bacteria to follow suit, causing a chain reaction. This makes the green light visible to the naked eye, alerting the consumer of the presence of the substance.
Along the way, we plan to build (and make available to future iGEM teams), many useful sub-systems which will include: a Histidine Kinase two component signaling system (which will detect new materials), 6 different double-repression toggle switches (along with the proper characterization), a chemically synthesized photo-switching molecule (activated by the green light produced by the bacteria themselves) which can connect cells, creating a synthetic biofilm, and a method of constructing genetic sequences with Gibson addresses which will make the high-throughput construction of complex biobricks possible.

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UCSF & UCB

OUR TEAM

The UCSF iGEM program was created in 2007, with the belief that students regardless of age could participate in synthetic biology. This year, UCSF and UCB have combined forces to produce a team composed of five graduates from San Francisco's Abraham Lincoln High School's Biotechnology Program, two returning iGEM alumni, two undergraduates from UC Berkeley, and one exchange student from Peking University. While we all have different backgrounds and knowledge, we are united in our desire to learn, contribute, and succeed.

OUR PROJECT

Project update (It can be a subpart of your project), what has happened, worked or failed in the past two weeks and why:
For teams that were not in the first issue, please try to give a really really brief summary of your project.
Summary:
In nature, many organisms must make multicellular decisions, whether the cells are part of a community of unicellular organisms or an organ in a multicellular organism. In some cases, the decision reaches a consensus and all cells respond similarly, such as in quorum sensing by some species of bacteria. Decisions may also favor a diversified response, in which some cells respond strongly to a signal while others are downregulated or cease to respond. For instance, in the human immune system, even though all T cells initially react to an antigen, only those with a strong response proliferate and produce an immune response. Many of these decisions are facilitated by a signaling factor, which the cells sense and produce more of.

Our goal is to understand how a group of cells uses sense and secrete communication to make a community decision. Therefore, we have chosen to pursue the Information Processing track.

We are designing multicellular systems in which different yeast strains communicate with each other to form a community decision. By engineering systems in which strains with variable initial responses develop the same response, or strains with the same initial response diverge to develop a bimodal response, we can model interesting communication systems, such as those of the immune system, leading to more novel insights about how cells interact to produce a specific response.

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USTC_CHINA IGEM TEAM

PROJECT UPDATE

In this week's Newletter, we are going to use more graphs to illustrate our ideas and process. If you have any questions or advice, please just email us :)

This week, we have been invited to the iGEM Conference in Taiwan, where we shared our work and results with many teams in Asia. That's a great trip and we learned a lot from this meetup!

This is the poster we used in the meetup which provides your more details about our project compared to last Newsletter.

Currently, we are trying to figure out the optimum conditions of C. Crescentus development, transformation and expression, which will tell us how to develop the holdfast in C.Crescentus within control. So, we can extract the gene regulating the expression of holdfast in C. Crescentus and build parts with the regulating system.

In the future, based on the current results, we will construct the light sensing-response system. And furthermore, to guide the accomplished system into E. coli and C. Crescentus as well as to test the function and efficiency of ribozymes.

You may be curious what this little project can lead us to. Here is our answer:

1. Plan the industrialization and further development in biological imaging industry
2. Design the projector specialized for biological imaging

Do you have more excellent ideas about this topic? Welcome to discuss with us!

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XMU-CHINA

OUR TEAM

Regardless of different personal traits and dispositions, we gathered here, in Xiamen University, striving for a common goal; In spite of various setbacks and difficulties, we united as a team, supporting each other and persevering in iGEM work.

The 2014 iGEM team of Xiamen University is a great one with over 20 members at the present. We each, from a broad range of background, are dedicated to explore the way how to utilize the synthetic biology to promote social progress like seeking to address the environmental problems with a wiser biological method and improve the public understanding toward such a subject. The constitution of our team is sophomoric and junior college undergraduates, among which former one holds the majority. As a youthful and energetic group, we XMU iGEMers are clinging to various innovative attempts and expecting to develop long-term friendships with other teams in different area sincerefully.

OUR PROJECT

This year, chemotaxis interests us a lot. We intend to reprogram the strain (CL-1) which lacks the CheZ gene to form mathematical patterns. CheZ gene belongs to chemotaxis family of E.coli, and protein CheZ can dephosphorylate CheY-P which allows E.coli to make smooth swimming. The ΔCheZ bacteria can't dephosphorylate CheY-P, therefore the strain isn't motile until CheZ is involved in. Based on this, the motility of E.coli can be precisely controlled by stimulus (such as IPTG). We try to construct logic gene circuits to make E.coli recognize environmental stimulation, thus by utilizing the controlled chemotaxis which named pseudotaxis we could command bacteria to form patterns such as ellipse, hyperbola and so on.

The intrinsic motivation that drive us striving for the above project is that we want to simulate the process of stem cell differentiation. In the organs development, stem cells differentiate while aggregate together to form heart, liver and kidney what have precise shapes. We think there must be some mathematical principles that govern the differentiation process. By simulating differentiation, we want to get a closer understanding of the differentiation process. However, E.coli can't sense as much stimulus as stem cell, we intend to utilize RNA aptamers what has the potential to response to almost all stimulus to cover that shortage. Thus, we can get a more precise stimulation.

We also try to utilize pseudotaxis to accomplish some experimental meaning. As far as we know, the motile ability is proportional to the amount of protein CheZ in certain range. By measuring the average chemotaxis distance, we can get a precise evaluation on the RBS efficiency which is evaluated by fluorescence strength previously.

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TEAM'S QUESTIONS

From Goettingen

To Valencia : Which insect pheromones are you using?
To Paris Bettencourt : No doubt there are persons who may feel insecure because of their personal odor and who will benefit from your project, but it seems that you are categorizing a single and only kind of "malodor". It's interesting to consider that the attitude towards body odor is a culture-related trait. How can the concepts of "strong personal odor" and "malodor" be defined in a multicultural context without any cultural bias? Wouldn't it be more politically correct to leave the users decide if they have "malodor"?

From Paris Bettencourt

Would any other iGEM teams like to repeat our experiment? They would project sad, happy and romantic movies in a controlled environment, and analyze the sweat samples by smelling them and rating the strength and pleasantness before and after.

From Valencia

How would you quantify the secretion of volatile compounds into the air? Would you use an alternative genetic switch to the cooper-activated one we're using? Do you think our biosafety module is safe enough? If not, how would you improve it?

From NJU-QIBEBT

How to manage time for experiments.
How to arrange different tasks for each team member.

From Purdue

Would you feel safe eating corn that was grown in soil with modified microbes in it, even if there was no threat to your health?

From StanfordBrownSpelman

How would you use a biological UAV?

From Sheffield

Who should be held responsible for repairing the damage caused by environmental pollutants (such as fats, oils and greases)?

From SJTU

How to build a fusion protein effectively?
If your projects consider the use of polymerase system?

From Technilon Israel

What would you like our system to detect? What materials interest you? How do you envision a home kit for material detection? What things are important for you in such a product? Would you use a product with bacteria at home? How but outside your home?
What kind of safety measures would you like the product to have?

From UCSF UCSB

How can simple cell signaling be used to model complex signaling systems on a larger level? How can we differentiate between different cell strains when they are intermixed? What are some ways to get more people interested in synthetic biology?

From XMU-China

We want to know that whether there is any easy methods to dye bacteria. Why some parts of RBS can't be transformed ? Could amino acid be sterilized at above 120 degrees Celsius zero ? We want to form a complex mathematic pattern through the chemotaxis of E.coli,dose it make sense? In the absence of external forces, is that ture self-assembly (self-organized) gene circuits can only form a circular pattern